Table 8. Total Savings (in $ Millions) for Potential Cost Savings Programs

Type of Plan	One-time costs Low	One-time costs High	Ongoing costs Low	Ongoing costs High
Reduced Telecom Rates (30%)	$89	$218	$39	$150
Reduced Telecom Rates (60%)	$179	$435	$69	$300
Purchasing by States (30% discount)	$1,849	$4,136	$45	$189
Support from Universities	$0	$0	$792	$1,800
Train teachers on own time	$0	$1,500	$0	$300
Free labor for installing network	$1,115	$3,088	$0	$0
Donation of PCs	$5,100	$10,200	$0	$0
Donation of Routers and CSU/DSU's	$221	$425	$0	$0
Donation of Servers	$243	$1,500	$0	$0
Free Internet Connectivity	$0	$0	$150	$630

1. Preferential telecommunications tariff rates are instituted for schools.

   Some state utility commissions have instituted preferential telecommunications rates for educational institutions. These rates are applicable for intrastate traffic only. For inter-state traffic, the tariffs set by the FCC are in effect. The federal Telecommunications Act of 1996 mandates unspecified preferable telecommunications rates for schools. The bill has commissioned the FCC to set the discount rate. This rate will affect the amount of money that schools will save. The following projections assume discounts of 30% and 60% respectively.

   Estimated savings: **$89M - $218M (One-Time)**

   (30% reduction) **$35M - $150M (Annual)**

   Estimated savings: **$179M - $435M (One-Time)**

   (60% reduction) **$69M - $300M (Annual)**

2. All technology purchasing is done at the state level.

   State-level technology purchasing, through the state department of education or other office, provides schools with better prices due to volume discounts. North Carolina is a good example of a state that has been successful in this program. Their schools have enjoyed discounts of 20% - 50% for hardware and labor costs. The following figures assume an average of 30% discount across all fifty States.

   Estimated savings: **$1.8B - $4.1B (One-Time)**

   $45M - $189M (Annual)

3. Universities or other institutions provide technical support to schools.

   Universities can also play a role in providing technical support to K-12 schools. Many universities have already undertaken such projects, and have provided network support to a number of K-12 schools in their areas. With this program, schools will reduce their in-house support staff budget by 80%.

   Estimated savings: **$792M - $1.8B (One-Time)**

4. Teachers trained on their own time.

   In the model, the training costs include costs for substitute teachers (to cover for teachers in training), and for supplemental teacher salaries (for their time in training outside school hours). If teachers were to agree to attend classes on their own time, there would be costs only for the trainer.

   Estimated savings: **$0 - $1.5B (One-Time)**

   $0 - $300M (Annual)

5. LAN installed by volunteers.

   In the model, labor constitutes 65% of the costs for installing the LAN. If schools can do this work with volunteers, then the cost savings are significant. For example, Val Verde

Unified School District in California laid its wires with volunteers including parents and community members. If these groups offer to provide labor at no cost to schools, schools will reap significant savings.

Estimated savings: $1.1B - $3.1B (One-Time)

6. Personal Computers are donated to schools.

   In the model, there is a need to purchase a significant number of PCs to provide 4-5 connections to the network in every classroom. Donations of new machines from PC manufacturers can effectively offset these significant costs. It is also possible for large corporations to donate these computers to schools. However, the schools will need fairly modern machines to run networking software. The success of a donation program is dependent on the quality of the equipment donated. Donations of obsolete or incompatible equipment may be very costly to schools.

   Estimated savings: $5.1B - $10.2B (One-Time)

7. Network routing equipment are donated to schools.

   The savings are lower than the similar PC program since routing equipment is less expensive.

   Estimated savings: $221M - $425M (One-Time)

8. Network servers are donated to schools.

   This program is similar to the PC donation and router donation programs.

   Estimated savings: $243M - $1.5B (One-Time)

9. Internet connectivity is made free to schools.

   Free Internet connectivity provides potential cost savings to schools. Provision would come through an Internet service provider or through a local university or community college.

   Estimated savings: $150M - $630M (Annual)

2.4 SUMMARY

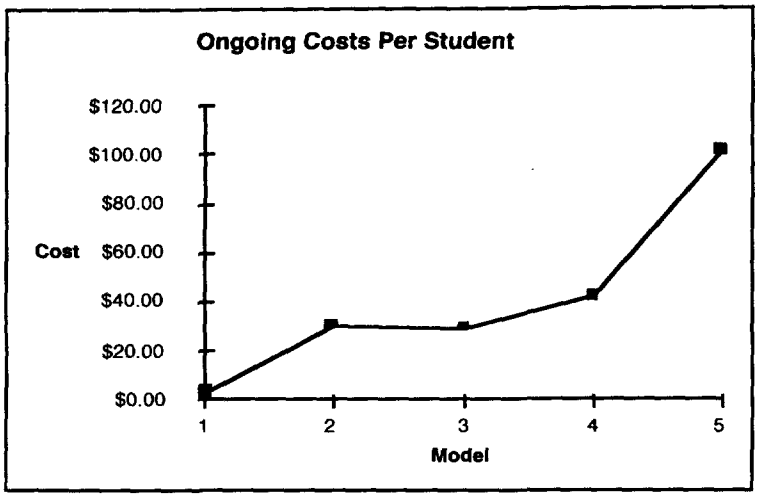
This chapter has developed a range of costs for five models of school networking. As the models increase in complexity, so do their costs and capabilities. The distribution of costs provides information about the key cost drivers for school networking.

The costs to network a school are complex. It is not simple to estimate the costs for a particular school. The costs for most schools will fall into a bounded range, but each particular school will vary greatly depending on its individual needs and characteristics. While this thesis put upper and lower bounds on the cost figures, the numbers are rough estimates at best.

The cost of the network hardware is only a small fraction of the overall networking costs. The largest one-time costs for building the network are training and retrofitting. The costs for the wiring and equipment are typically not as high. Support of the network is the largest ongoing annual cost that schools must face.

Although the five models represent a rough continuum of technological development, the transitions from model one to model two and from model four to model five are the most costly transitions, as illustrated in Figure 9. The first jump in cost arises when the school installs the LAN. At that point the school and district must pay to have the network installed and to employ full-time support staff. The second jump arises if and when the school decides to purchase computers for all students to use. Since the number of networkable PCs is inadequate for most schools, there is a significant cost to provide multiple PCs in every classroom. In addition, many schools require major electrical work, possibly exceeding $100,000, to support the increased number of PCs in the school. Between models two and three and between models three and four, as well as within each model, costs can be incremental.

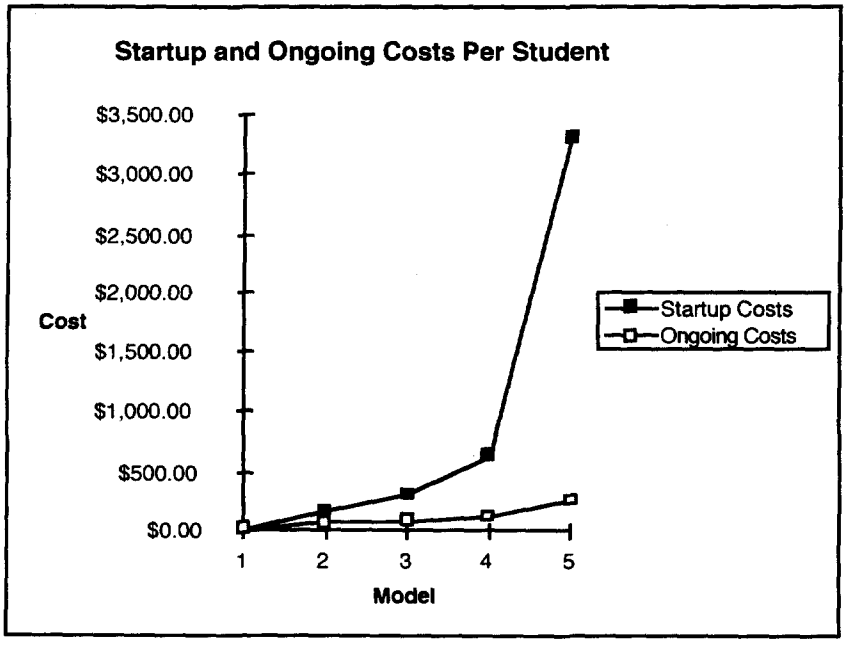
Figure 9. Ongoing Costs Per Student Per Model



SOURCE: MIT Research Program on Communications Policy, 1994

The startup cost for the network increases at a faster rate than the annual ongoing cost as the network complexity increases, as illustrated in Figure 10.

Figure 10. Startup and Ongoing Costs Per Student Per Model



SOURCE: MIT Research Program on Communications Policy, 1994

In the less complex models, the one-time startup costs are 2-3 times the annual ongoing costs of the network. However, for the more complex models (i.e., models four and five) the one-time costs are 5-15 times annual costs. The divergence indicates that the most significant hurdle that a school will face is the initial investment costs in the network and computers. Schools should be given flexibility to amortize initial costs, to spread the burden over multiple budget years.

Purchasing of technology equipment at the state and district levels can significantly reduce costs. Schools stand to save much money by pooling resources and purchasing power with other schools in the district and at the state level. When schools share a high speed data link, or support staff, the per school costs drop considerably. Schools in North Carolina and Kentucky have saved 20% - 50% by purchasing services and equipment at the state level.[16]

Further research on the costs of wireless and cable Internet access methods for schools is recommended to elucidate the costs and benefits of these approaches. In addition, the issue of software and equipment cost accounting require further analysis. It is hoped that this preliminary assessment of the costs of networking schools can provide a point of departure for analysis of these and other more detailed models of school connectivity.

[16] Phone conversations with officials at the North Carolina and Kentucky Departments of Education.

Chapter Three

Educational Networking Benefits

3.1 INTRODUCTION

The previous chapter described a series of technology models and associated costs for networking K-12 schools. For each successive model, costs increase due to increased bandwidth, equipment, training, and support. If schools were interested solely in minimizing costs, they would choose the lowest level of technology or none at all. However, schools invest in technology to take advantage of the educational, administrative, and other benefits of the technology. Since the benefits achievable through each of the five models should increase as the model increases in complexity, the purchase and implementation decisions made by a school depend on where it wants to be along the cost-benefit curve.

This chapter will briefly examine the types of networking services that schools can use for each of the five technology models developed in the previous chapter. The chapter will then describe a case study of a new networked multimedia service, Internet CNN NEWSROOM, and its use at a pilot site. The site was chosen because its advanced networking infrastructure, comparable to a model four / model five hybrid, is necessary to access multimedia services over the Internet.

3.2 EDUCATIONAL BENEFITS

A financial cost estimate in dollar terms provides a reasonably good quantitative measure of the cost for educational networking. In contrast, there are virtually no universally accepted quantitative measures of benefit in education. Education experts have argued for some time about how to measure the benefits of technology in schools.

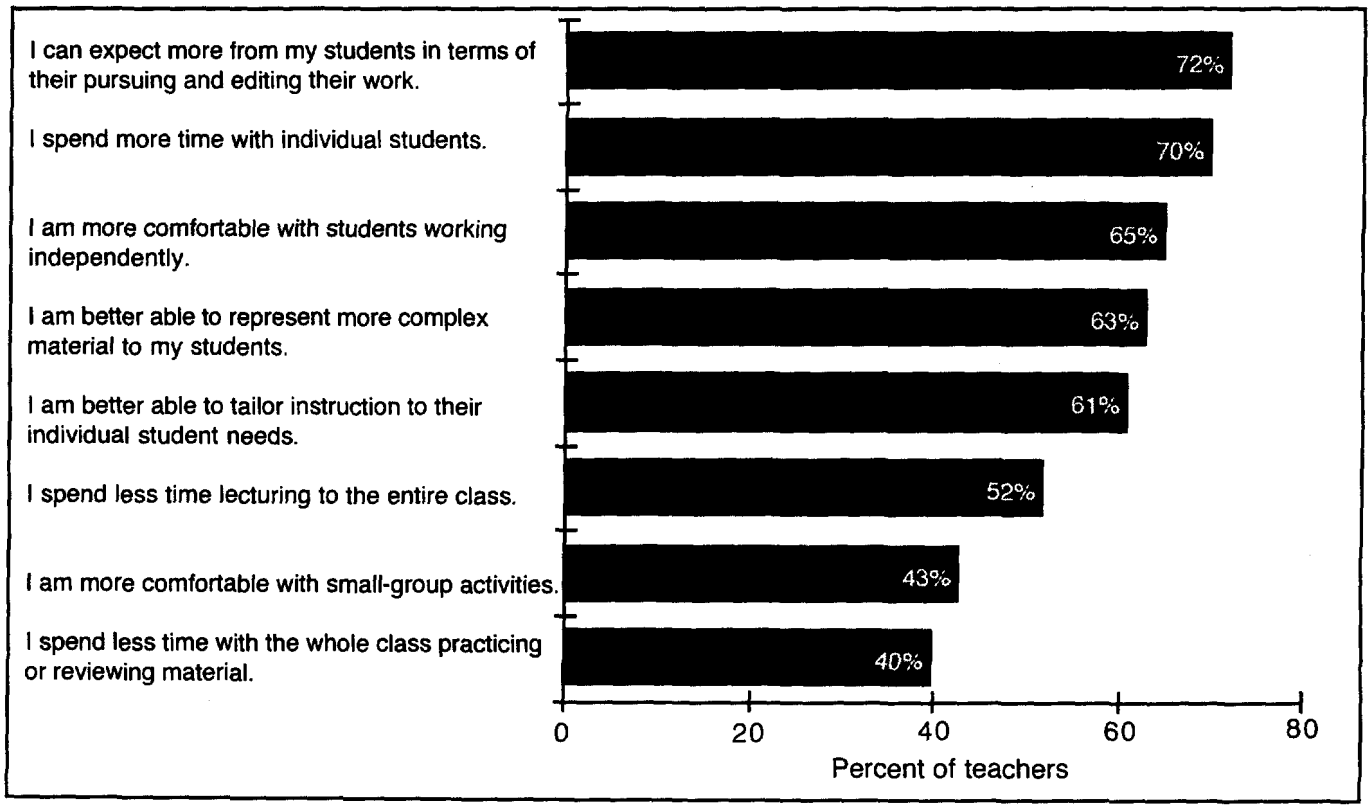
In this thesis, the benefit of a technology is viewed in terms of user acceptance of the technology. In K-12 schools, the education process occurs almost exclusively in the classroom. Inside the classroom, only the teacher and the student are in ultimate control of success or failure in the educational process. Therefore, in order for technology to have a constructive role in education, the technology must first gain acceptance from both teacher and student. User acceptance is only one way to measure technology benefits; there exists a wide body of research on the measurement of the pedagogical, instructional, and psychological benefits of technology in education.

This chapter evaluates the benefits of networking technology in schools through its use and acceptance by teachers and students. When teachers and students use technology, they implicitly assert that the technology provides them with real user benefits. It is true that use of the technology is not a sufficient indicator that it provides educational benefit, since the technology can be used for non-educational purposes. However, if the technology contains educational content and is used for educational purposes, then greater interest in and use of the technology implies that it is providing educational benefits in the classroom.

3.2.1 Benefits of Stand-Alone Computers in Education

U.S. Congress, Office of Technology Assessment (1995) describes a study where "accomplished computer-using" teachers described the advantages of computers in their classrooms. As shown in Figure 11, teachers cite student independence and greater flexibility in the classroom as the greatest benefits of computers in their classes.

Figure 11. Percentage of Accomplished Computer-Using Teachers Agreeing with the Following Statement



Source: U.S. Congress, Office of Technology Assessment (1995)

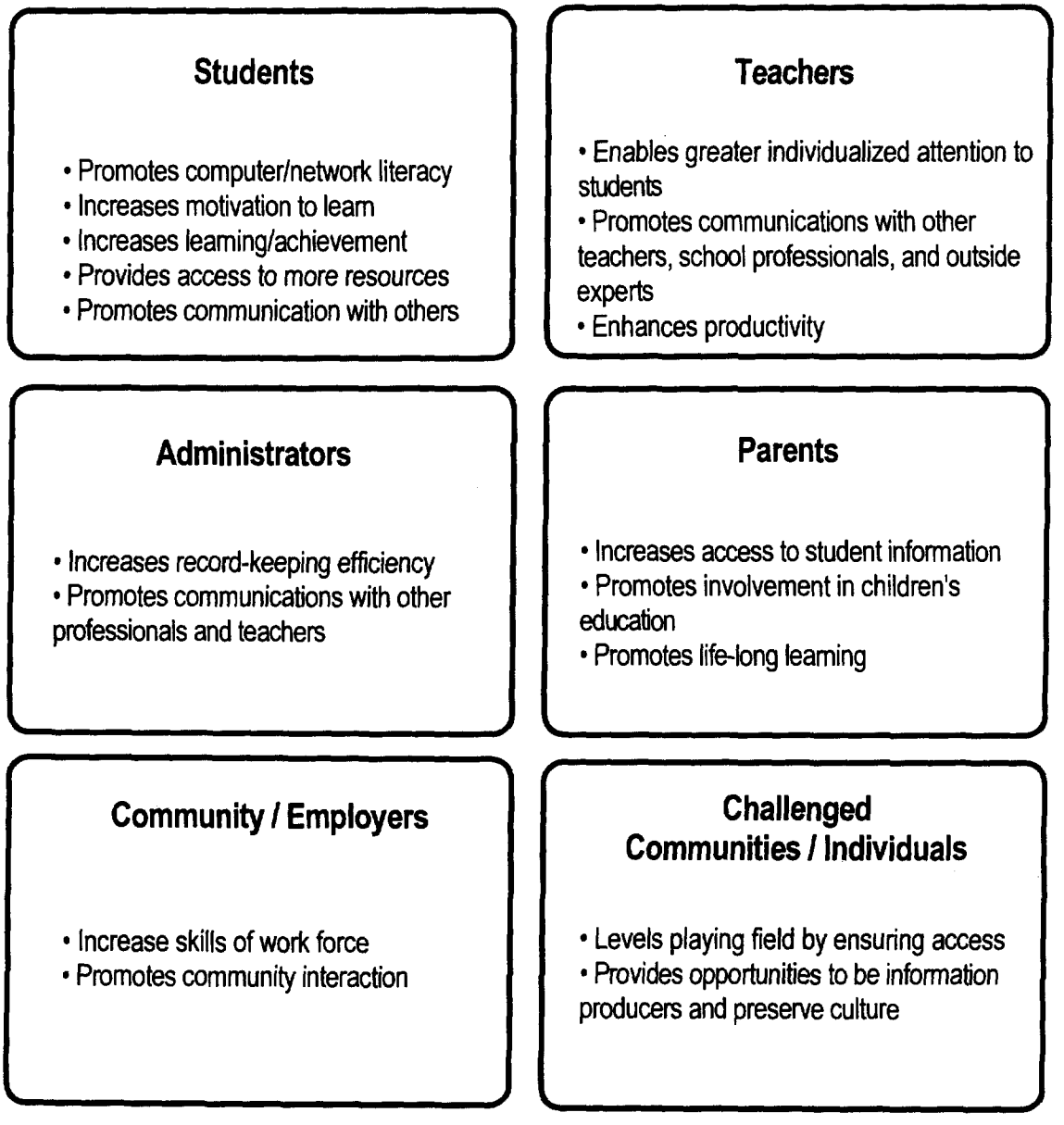
U.S. Congress, Office of Technology Assessment (1995) considered the benefits of stand-alone computing only. Since networking computers within schools is a relatively recent phenomenon, there is less research describing the benefits of networking technology in schools.

3.2.2 Benefits of Educational Networking

A computer with a network connection, to a school LAN or to the Internet or both, has greater capabilities than a non-networked computer. The networked computer is more valuable than the particular software loaded on it, because the networked computer can be used for remote information access (to virtual libraries and educational materials) or for communication with other computer users (including other students, teachers, parents, and professionals).

Figure 12, from McKinsey (1995), describes some of the benefits that students, teachers, and other education stakeholders can gain through computer networking. Students use networks in the learning process within the classroom. Teachers use networks, for both instruction within the classroom and professional development outside of class. Administrators use networking to streamline administrative functions. Parents use networks to have greater access to the schools their children attend. Employers and the community benefit from the increased skills of school graduates in their work force. Networks also provide unique benefits for those with special educational needs or for the physically challenged. Finally, networks allow diverse communities to access and create information equally. The extent to which these stakeholders take advantage of these educational benefits depends on the amount, quality, and accessibility of technology in the classroom.

Figure 12. Computer Networking Benefits to Education Stakeholders



Source: McKinsey (1995)

3.2.3 Review of Technology Models

For each of the models developed in the previous chapter, schools will receive a different quality of service. For the less advanced models, there will be relatively few computers per student and lower network connection speeds. As the models increase in complexity, there are more computers per student and the network connection speed increases.

Model One: Single PC Dialup – One user may use the connection at any time. Users of the system will be able to use text-based applications over the Internet. However, performance will be poor accessing graphical network applications, such as the Web.

Model Two: LAN with Shared Modem – By connecting the modem to the LAN, every computer on the network has access to the Internet. However, this model supports only a few users at a time, limited by the number of phone lines going out of the school. Just as in model one, performance is poor when accessing graphical network applications.

Model Three: LAN with Router – With the addition of a router, multiple users of the LAN may access the Internet concurrently. Performance may be better than in the first two models, but it will still be mediocre at best in accessing graphical and multimedia network applications.

Model Four: LAN with Local Server and Dedicated Line – The primary difference between this model and the former one is the existence of a file server at the school. The on-site server allows much of the information to reside locally at the school instead of at the district office. This feature provides better performance since there is less need for remote information access over the network.[17] Additionally, the local server allows school administrators to exercise greater

[17] The local server can act as a proxy/cache server used to store files that are frequently accessed over the Internet. In some schools, the local cache server has been able to service over 90% of the file requests with information in the cache. Further, the local cache can provide performance of over 1 Mbps. (Source: Presentation by Gary Warren, NASA Research Scientist, at the EPIE Institute Workshop, June 1996)

control over the information that flows in and out of the school. Higher speed links from the school enable much better performance for graphical and limited video network applications.

Model Five: Ubiquitous LAN with Local Server and High-Speed Line – In this model, there is a PC on the desktop of every student and teacher. There is a high-bandwidth connection to the school to support large numbers of concurrent users of the system. High speed links from the school enable excellent performance even for highly graphical and limited video network applications.

Table 9 provides a summary of the performance characteristics for each of the five models.

Table 9. Architecture Model Benefits

Model	Supports multiple network users?	Graphical application performance
1	No	Very poor
2	No	Very poor
3	Yes	Poor
4	Yes	Good
5	Yes	Excellent

3.3 PRODUCT BACKGROUND

Given the benefits that technology and networking can provide to schools, this thesis will examine a case study of the use of a new networked educational product in schools. Internet CNN NEWSROOM, a networked multimedia program based on the CNN NEWSROOM program, is part of the Networked Multimedia Information Services (NMIS) project at MIT.[18] It is a collaborative project between Turner Broadcasting System Inc. and MIT. A complete multimedia news program is automatically generated from CNN NEWSROOM content on a daily basis and made available on the Internet via the World Wide Web.

3.3.1 CNN NEWSROOM

CNN NEWSROOM is a thirty-minute per day commercial-free video program developed by Turner Educational Services, Inc., a division of Turner Broadcasting System Inc. The target audiences of CNN NEWSROOM are primary and secondary school classrooms as part of cable television's "Cable in the Classroom" initiative. CNN NEWSROOM's composition changes on a daily basis, but it generally consists of 8-10 segments of 2-5 minutes each. Almost 30,000 schools in the U.S. and Canada use CNN NEWSROOM.

Many teachers find CNN NEWSROOM to be of great value in their classrooms. Teachers report that students tend to show more interest in geography and in other cultures as they learn about different parts of the world via CNN NEWSROOM. Students state that they are more active in following and discussing news events. Students like the video format and the relevant and timely content of CNN NEWSROOM.[19]

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[18] As described in Center for Advanced Engineering Studies (1994), "the Networked Multimedia Information Services (NMIS) is a project at MIT that conducts research on vital NII technologies. Deliverables include new software, innovative applications and services, architectural analyses of NII/Multimedia technologies, and policy recommendations." Internet CNN NEWSROOM is one of the major deliverables of the NMIS project.

[19] Burkart, Rockman and Ittleson (1991).

3.3.2 Internet CNN NEWSROOM

Internet CNN NEWSROOM is an Internet-based educational service derived from CNN NEWSROOM. As described in Compton (1995), a server at MIT generates Internet CNN NEWSROOM automatically on a daily basis from the CNN NEWSROOM broadcast. At the Center for Advanced Educational Services at MIT, a VCR automatically records the early-morning CNN NEWSROOM broadcast over the CNN cable TV channel. Then, an automated script performs two tasks – first, it translates the analog video stream into an MPEG digital file and, second, it extracts the closed caption text embedded in the video signal into a separate digital text file. A script divides the video and text files into multiple segments using the time code report received from Turner Broadcasting. Finally, the script creates a new Web page that contains links to each of the day's digital video segment files and its accompanying closed caption texts. The uniform resource locator (URL) for Internet CNN NEWSROOM is http://nmis.nmis.org/NewsInteractive/CNN/Newsroom/contents.html. Appendix One displays a typical day's Internet CNN NEWSROOM home page.

Since Internet CNN NEWSROOM is a prototype, it is not surprising that it contains a number of product design and implementation imperfections. Occasionally, the software malfunctions and the Web page must be created manually. Often the end of the video segments in Internet CNN NEWSROOM is cut off and appears at the start of the subsequent video file. This misalignment occurs because the time code file does not always exactly match the true time sequence of the CNN NEWSROOM broadcast. Layout of the Web site is not straightforward and navigation through the site can be confusing. Also, the Web site does not include any user feedback capabilities. Finally, this Internet CNN NEWSROOM prototype includes only a rudimentary search tool that does not permit complex searching.

3.4 EXPERIMENTAL PROTOCOL

3.4.1 Study and Control Groups

The pilot study group for Internet CNN NEWSROOM included two social studies classes in Lexington High School. These classes were chosen for three reasons:

- The Lexington school district has a 10 Mbps connection to the Internet through the district cable television backbone. A high-speed connection is necessary to receive a tolerable level of quality in the streaming MPEG video files of Internet CNN NEWSROOM.
- Lexington's proximity to MIT facilitated frequent study and communication with the school.
- The teacher at Lexington High School had formerly used CNN NEWSROOM as part of her regular instruction. She expressed interest in the greater use of technology in her classroom and desired to use Internet CNN NEWSROOM on a regular basis.

The Lexington study group (LEXSTUDY) consisted of a pair of tenth grade social studies classes called "Global Studies." In the classes, students learned about global civilizations and current events. The classes were not part of the school's honors track, but the class included six honors students. The teacher of these classes used Internet CNN NEWSROOM on a regular basis (2-3 times per week) throughout the study period.

There were two control groups used in the study. The first control group (LEXCONTROL), a third tenth grade Global Studies class in Lexington High School, has a curriculum similar to that of LEXSTUDY. There were approximately twenty-five students in the class. The teacher of this class used neither Internet CNN NEWSROOM nor CNN NEWSROOM in her instruction.

The second control group (BELCONTROL) was a pair of ninth grade social studies classes, called "American Studies," in Belmont High School in Belmont, Massachusetts. The teacher of these classes focused on American history interlaced with brief discussions of current events.

The teacher of these classes used neither Internet CNN NEWSROOM nor CNN NEWSROOM in his instruction. While Belmont High School has above-average resources and technology infrastructure, it has fewer resources than technology-rich Lexington High School.

3.4.2 Evaluation Methodology

Four independent focus groups of 4-5 students each from the LEXSTUDY class were conducted in January 1996 to generate verbal feedback on the use of Internet CNN NEWSROOM. The students were given the option of not participating in the focus groups and of remaining anonymous if they did participate. In the focus groups, students described their impressions of Internet CNN NEWSROOM, computing, and the Internet. The focus group protocol used in this study is described in Appendix Two.

An identical survey was distributed to the study and control group classes three times during the school year. Appendix Three contains a copy of the survey used in this study. The survey contained two parts. The first part, containing sixteen multiple choice questions and one open-ended question, probed student interest in and attitudes towards school, current events, computers, and networking. The second part, containing three multiple choice questions and two open-ended questions, elicited direct response about student usage and impressions of Internet CNN NEWSROOM. Only the LEXSTUDY group received part two since it was the only group to use Internet CNN NEWSROOM. The first survey round administered to the LEXSTUDY group did not include part two because the class had not yet used the service in class.

The surveys were administered in September 1995, January 1996, and April 1996. Table 10 lists the response rate for each of the three survey rounds.

Table 10. Survey Response Rate

	September 1995	January 1996	April 1996
LEXSTUDY	31	24	26
LEXCONTROL	24	16	17
BELCONTROL	44	40	32

The teachers for each class compiled a list of random ID numbers for each of their students (e.g., LEXA01 through LEXA20). The random ID numbers facilitated tracking of students on an individual basis. This system preserved student privacy because only the teachers used the name list, and the teacher did not have access to the survey data. When the students received the survey to complete, their assigned random ID appeared at the top of the survey. However, only the teacher possessed the table that linked the ID numbers to the names of the students. All students signed a compliance agreement to participate in the survey.

3.4.3 Demographic Factors

The towns in which this study was conducted – Lexington, Massachusetts and Belmont, Massachusetts – are similar in demographic and socioeconomic composition, but are significantly more affluent than the typical U.S. town. The per capita incomes of Lexington and Belmont in 1990 were $30,718 and $26,793 respectively, compared to $18,666 for all towns in the U.S. The ethnic profiles of Lexington (92% white, 6% Asian) and of Belmont (96% white, 3% Asian) are more homogenous than that of the U.S. (74% white, 12% black, 10% Hispanic, 3% Asian).[20,21] Lexington and Belmont schools also had greater per pupil expenditures ($6,498 and $5,856 respectively) than the average in Massachusetts ($5,235) and the U.S. ($4,407).[22,23]

[20] *Massachusetts Municipal Profiles* (1995).
[21] U.S. Department of Commerce Census Bureau (1996).
[22] Massachusetts Department of Education (1996).
[23] U. S. Department of Education (1994).

The students at the public high schools in Lexington and Belmont constitute a relatively unbiased sample of children in the towns, since only a small percentage of students attend private schools (7% in Lexington and 10% in Belmont). Therefore, the students in the study are generally representative of the towns in which they live.

3.5 PRODUCT EVALUATION FINDINGS

This section describes the findings based on the surveys, student focus groups, and teacher interviews conducted during the study. Students and the teacher were generally happy with Internet CNN NEWSROOM. The Internet product provided a number of benefits over the broadcast version. However, the initial excitement about the product in the first few months of using Internet CNN NEWSROOM greatly subsided during the latter half of the study. See Appendix Four for a compilation of all responses to the survey.

3.5.1 User Feedback

Overall, students in the LEXSTUDY group had a positive experience with Internet CNN NEWSROOM in the classroom. By the end of the study, seventy-one percent of the students expressed a desire to use it more often or just as often as is currently used in class.

The teacher said that students have more enthusiasm for Internet CNN NEWSROOM than for other class projects or materials:

> The students are asking to use it more during regular class and to be able to use it on their own...I wouldn't change a thing. I wish I could use it more.
>
> I have found that these students come in during their study halls. They can get passes to come from their study halls to use Internet CNN NEWSROOM and to look in the archive and daily news. So that if I don't have the time in the classroom – the daily periods that the students come in themselves and have access to this. And that impresses me. That they're willing to come in on their own time, be it during study halls, after school, or before school.

She attributed this enthusiasm to the direct access students have to the information:

> The students feel more ownership of the news content over the Internet even though it's the same broadcast because they can put their hands on it. I know it's the same as on a videotape, but it's different for the kids. It's a lot different than if I pushed in a tape. For some reason or other, this is more real to them.

However, statements by the students revealed that they are not absorbing the content of Internet CNN NEWSROOM fully. Before students in Lexington watch Internet CNN NEWSROOM, the teacher distributes a list of short answer questions based on the video segments she will play for the class. Since the students need to look for detailed information embedded in the news stories, they may not be able to fully concentrate on the overall significance and message of the news story. One student said:

> I like [Internet CNN NEWSROOM]. But the questions she (the teacher) gives us is the only thing that I don't like. [The teacher] makes out a list of questions and I don't like it because she turns it into homework. But we can't really get the information. It's hard to get the detail when [the video segment is] so quick.

Additionally, some students complained that the teacher has not sufficiently integrated Internet CNN NEWSROOM with the rest of the course material:

> We'll talk about something totally different and then, okay, in the back of the room. It doesn't really tie in to what we're doing all the time.

As described in the next section, frustration with usage of Internet CNN NEWSROOM in the classroom may cause students to be less interested about the technology over time.

LEXSTUDY students expressed a desire to learn how to use Internet CNN NEWSROOM features and capabilities. By the end of the study only 29% of the students said they know how to play a video news segment, while 75% expressed a desire to know how. Twenty-one percent said they know how to incorporate information from news segments into class projects,

whereas 54% would like to do it. Only 17% know how to copy video, pictures or text from the news segments into a class project, yet 46% expressed a desire to learn.

Students reported that the video presentation of current events in Internet CNN NEWSROOM was much more powerful than text in a book:

> Like the Internet, it's like, I know what's really going on. I know about the people, I know, I see videos on what's happening. If I'm looking in a book, I don't see any of that.

The teacher echoed statements by the students that the video content provided extra learning value to certain students:

> It's wonderful for the visual learner. I can see some of these students trying to learn on their own; just even taking notes is difficult for them. But this way it can be organized and it looks neat and they can pick and choose what they want and I can't say enough for it. I truly believe that there were a tremendous number of students that are being saved because they are using technology. I really do.

However, some students did say that it was difficult to use the video for school projects and found text easier to work with:

> I loaded down some stuff on Mayans. It was really nice. But I didn't know how to present video.
>
> It's easier to get text than video.

Students did express a great interest in using video clips from Internet CNN NEWSROOM for their research reports:

> It would be nice if you could load the whole thing up and then save a frame on a disk for a project so I can use it on a Hypercard stack.

Despite their general affinity towards Internet CNN NEWSROOM in the classroom, not all students were eager to use it outside class:

> Maybe [I would use Internet CNN NEWSROOM on my own], if I didn't have any work to do.

However, many of the students agreed that the use of computers in the classroom was a primary motivation for getting one at home, and several of them planned to do so soon.

Part of the hesitation to use Internet CNN NEWSROOM stems from a lack of knowledge about using computers, the Internet, and the Internet CNN NEWSROOM interface. These students complained that the system is still too complex and there needs to be student training on using the technology:

> It would be nice to work with someone who understands how to use the computer.
>
> Yeah, every time we get on [the computers], somebody has to come in and set it up for us and then something happens. I guess it's just too complicated that they can't take the time to show us how to do it, although I know some of us would get it. If two people in the class would get it, imagine how many more people, but they just don't want to sit down and tell us this is how you work it.
>
> I don't know how to use the Web.

The teacher also called for greater training of the system to both teachers and students. She cited the technical instability of the product as its single drawback:

> It's easy to use when the system is up. (Laughter.) That's my only complaint.
>
> I think [more training] would be beneficial to all of us. Frequently we have difficulty with it. I think they do need more training of how we could use the on-line archives. I think we need in-service training for teachers and students.

The students noted that the system was likely to fail after an extended period of use. It was then up to the student teacher or the "computer geniuses" in the class to fix things. Most other students did not understand the technology very well. For example, in the focus groups, most students could not distinguish between Internet CNN NEWSROOM and the Internet in general.

In the surveys conducted in January and April, LEXSTUDY students answered what they liked most about Internet CNN NEWSROOM. Table 11 lists the answers received from the students.[24]

Table 11. User Responses to "What do you like most about Internet CNN NEWSROOM?"

January	April
Search capabilities (35%)	Informative (56%)
Easy to use (20%)	Search capabilities (13%)
Informative (20%)	Easy to use (13%)
Nothing/Don't know (15%)	Multimedia (13%)
Multimedia (10%)	Fast (13%)
Fast (10%)	Interesting (6%)
Interactive (5%)	Up to date (6%)
Up to date (5%)	On demand (6%)
Clear stories (5%)	
Fun (5%)	

The top three answers in both rounds cited the product's search capabilities, ease-of-use, and informative content. The search capabilities and ease-of-use are particular to the Internet version, whereas the content is identical to the broadcast CNN NEWSROOM. From January to April the students cited the networked version features less often (35% for searching and 20% for ease-of-use in January versus 13% for each in April) and the general product features more often (20% for informative content in January versus 56% in April). This trend indicates that over time the students either became less excited by the features provided by the networked version, or began to take them for granted.

In the focus groups, students lauded the product benefits of Internet CNN NEWSROOM. They found it quicker to find the desired video segment using the Internet than using a video tape:

[24] Note that the percentages do not add up to 100% because some students listed more than one feature.

> I think it's good just to be able to watch the news without having to watch the whole thing and have it in the background. You can load it right up without having to worry about it. It's there. We used to tape it and then load it and wait twenty minutes. This way you just click on a button and it goes.
>
> I know CNN repeats every thirty minutes. And then it's really hard to, like, if I'm looking for a certain topic, I might miss some, and then I have to watch it again. There's like a whole lot of other things that they're talking about that have nothing to do with what interests me.

Students also liked the archive of Internet CNN NEWSROOM stories that is available through the Web site:

> I think it's a really great tool for research for the classroom. It's really helped us out a lot. There's a lot of information that we can use.
>
> I found some news articles [for a report on Peru].

Some students took advantage of the archive search tool while others did not.

> When you watch the news, you have to wait, you have to look at everything. But you just type in a topic that you want to watch and it comes right up, and everything's right there.
>
> I didn't really use it. All I do is watch it when it's used.

While students used Internet CNN NEWSROOM for highly publicized issues, students used other sources on the Internet for research on less popular issues.

> Some reports we would go strictly just like the basic Internet, and there were a few other reports that we looked up in the Internet CNN Newsroom and tried to find some things. It just depends on the issue that you're researching and whether or not it's something that's going to make big news or not.
>
> Things that are like, more well known, something that's sort of a bigger issue like, we did some reports on Bosnia. That's something you could find on any newscast. I did another report on Somaliland. It hasn't made big news, so I didn't bother looking at the CNN.

Students liked the simple interface of Internet CNN NEWSROOM.

> I think [the Internet CNN NEWSROOM interface is] pretty straightforward. It's not very complicated to use. It's pretty easy compared to everything else.
>
> They showed it to us and it looked like something really easy to figure it out and everything, so we just did it.
>
> The Internet's confusing. I don't like it. You can't open up the files that you sometimes want because I don't know why, but it doesn't work correctly. [However,] Internet CNN Newsroom is going to come up, so all you have to do is click and it's there for you.

In interviews with the teacher, she cited that the most important benefit of using the Internet version of CNN NEWSROOM over the broadcast version is collection of all the content and accompanying material into a single location (i.e., the Web site) with minimal effort required on her part:

> I didn't use the teacher's study guide [before we started using Internet CNN NEWSROOM]. I think it might have been available but I was not quite aware where I would get it.
>
> What I like about [Internet CNN NEWSROOM] is that it's readily available. Also, I don't have to be responsible for taping it. Before this I used to tape the programs off of cable at home at three o'clock in the morning and my husband would download the daily program guide through America Online. Then, I would take the tape into school, hope I could find a VCR to play it on. [With Internet CNN NEWSROOM,] I know it's going to be there. I know that the news broadcast will be there at seven o'clock in the morning. We know that we can download it.

In the survey, students also said what they liked least about Internet CNN NEWSROOM. User responses were similar in the January and April surveys, as illustrated in Table 12. The most popular answer, coming from half of the student body, cited frustration with the pauses in the video playback. Other students cited that they did not know how to use the system or that it was boring.